Claims

[c1]   1. A method of reducing wastes produced from an industrial process, comprising:

communicating with a communications network and acquiring process information concerning the industrial process;

predicting a process parameter associated with a predicted waste output according to a predetermined model and based on the process information; and

communicating the process parameter over the communications network.

[c2]   2. A method of reducing wastes according to claim 1, wherein the step of communicating with a communications network comprises communicating with a globally distributed computing network.

[c3]   3. A method of reducing wastes according to claim 1, wherein the step of communicating with a communications network comprises communicating with at least one of a local area network, a wide area network, and a globally distributed computing network.

[c4]   4. A method of reducing wastes according to claim 1, wherein the step of acquiring process information comprises acquiring at least one of i) concentration of a chemical species used by the industrial process, ii) concentration of a pollutant produced by the industrial process, iii) concentration of an effluent discharged from the industrial process, iv) flow rate of the chemical species used by the industrial process, v) flow rate of the pollutant produced by the industrial process, and vi) flow rate of the effluent discharged from the industrial process.

[c5]   5. A method of reducing wastes according to claim 1, wherein the step of acquiring process information concerning the industrial process comprises acquiring information concerning at least one of an effluent stream of air, an effluent stream of water, and an effluent stream of a solid.

[c6]   6. A method of reducing wastes according to claim 1, wherein the step of acquiring process information comprises acquiring information concerning at least one of i) inorganic materials used by the industrial process and ii) inorganic materials discharged from the industrial process.

[c7]   7. A method of reducing wastes according to claim 1, wherein the step of acquiring process information comprises acquiring information concerning at least one of i) a

species of acid used by the industrial process and ii) a species of acid discharged from the industrial process.

[c8] 8. A method of reducing wastes according to claim 7, further comprising acquiring information concerning a chemical compound that ionizes in water to provide a hydrogen ion H$^+$.

[c9] 9. A method of reducing wastes according to claim 7, further comprising acquiring information concerning at least one of hydrochloric acid (HCl), nitric acid (HNO$_3$), perchloric acid (HClO$_4$), sulfuric acid (H$_2$SO$_4$), phosphoric acid (H$_3$PO$_4$), acetic acid (HC$_2$H$_3$O$_2$), hydrogen fluoride (HF), and carbonic acid (H$_2$CO$_3$).

[c10] 10. A method of reducing wastes according to claim 1, wherein the step of acquiring process information comprises acquiring information concerning at least one of i) a heavy metal species used by the industrial process and ii) a heavy metal species discharged from the industrial process.

[c11] 11. A method of reducing wastes according to claim 10, further comprising acquiring information concerning at least one of lead (Pb), mercury (Hg), chromium (Cr), copper (Cu), and cadmium (Cd).

[c12] 12. A method of reducing wastes according to claim 1, wherein the step of acquiring process information comprises acquiring information concerning at least one of i) an organic species used by the industrial process and ii) an organic species discharged from the industrial process.

[c13] 13. A method of reducing wastes according to claim 12, further comprising acquiring information concerning at least one of an alkane, an alcohol, an ether, an alkene, an alkyne, an aromatic compound, an alkyl halide, an ester, a carboxylic acid, a carbonyl compound, an aldehyde, and a ketone, an amine, and an amide.

[c14] 14. A method of reducing wastes according to claim 12, further comprising acquiring information concerning at least one of benzene (C$_6$H$_6$), toluene (C$_6$H$_5$CH$_3$), xylene [C$_6$H$_4$(CH$_3$)$_2$], naphthalene (C$_{10}$H$_8$), dichloromethane (CH$_2$Cl$_2$), trichloromethane (CHCl$_3$), styrene, ethylene, phenol, methylene chloride, xylene, and methyl ethyl ketone.

[c15] 15. A method of reducing wastes according to claim 1, further comprising acquiring

information concerning air pollutant emissions produced by the industrial process.

[c16]   16. A method of reducing wastes according to claim 1, further comprising acquiring information concerning a volatile organic compound produced by the industrial process.

[c17]   17. A method of reducing wastes according to claim 1, further comprising acquiring information concerning an ozone depleting compound produced by the industrial process.

[c18]   18. A method of reducing wastes according to claim 1, further comprising forecasting wastes produced by the industrial process, the forecasted wastes based upon the process information.

[c19]   19. A method of reducing wastes according to claim 1, further comprising simulating the industrial process with a computer program that determines the process parameters.

[c20]   20. A method of reducing wastes according to claim 1, further comprising forecasting costs of operating the industrial process at the process parameter.

[c21]   21. A method of reducing wastes according to claim 1, further comprising estimating costs of operating the industrial process at the process parameter.

[c22]   22. A method of reducing wastes according to claim 1, further comprising communicating information concerning waste emissions over the communications network to a regulatory agency.

[c23]   23. A method of reducing wastes according to claim 1, further comprising communicating information concerning waste emissions over the communications network to participants in a system for buying and selling emissions allowances.

[c24]

24. A method of reducing wastes produced from an industrial process, comprising:
communicating with a globally distributed computing network and acquiring process information concerning the industrial process, the process information comprising at least one of i) concentration of a chemical species used by the industrial process, ii) concentration of a pollutant produced by the industrial process, iii) concentration of an effluent discharged from the industrial process,

iv) flow rate of the chemical species used by the industrial process, v) flow rate of the pollutant produced by the industrial process, and vi) flow rate of the effluent discharged from the industrial process;

predicting a process parameter associated with a predicted waste output according to a predetermined model and based on the process information; and

communicating the process parameter over the globally distributed computing network.

[c25]   25. A method of displaying industrial waste information from an industrial process, the method comprising:

acquiring process information concerning the industrial process, the process information acquired from a globally distributed computing network, the process information comprising at least one of i) concentration of a chemical species used by the industrial process, ii) concentration of a pollutant produced by the industrial process, iii) concentration of an effluent discharged from the industrial process, iv) flow rate of the chemical species used by the industrial process, v) flow rate of the pollutant produced by the industrial process, and vi) flow rate of the effluent discharged from the industrial process;

acquiring a process parameter that may reduce waste from the industrial process; and

displaying an image comprising at least one of the process information and the process parameter.

[c26]   26. A method of displaying industrial waste information according to claim 25, further comprising dynamically updating said image.

[c27]   27. A method of displaying industrial waste information according to claim 25, further comprising dynamically updating said image independent of intervention by a user.

[c28]   28. A method of displaying industrial waste information according to claim 25, further comprising requesting a dynamic update of said image.

[c29]

29. A waste management system, comprising:

at least one of i) a source producing a pollutant and ii) a source discharging an effluent;

at least one of i) a pollutant monitor for monitoring the pollutant produced by

the source and ii) an effluent monitor for monitoring the effluent discharged by the source, the pollutant monitor producing pollutant information and the effluent monitor producing effluent information; and

a Waste Reduction module acquiring at least one of the pollutant information and the effluent information communicated along a communications network, the Waste Reduction module predicting process parameters that may reduce wastes produced by the industrial process.

[c30]   30. A waste management system according to claim 29, wherein the communications network comprises at least one of a local area network and a wide area network.

[c31]   31. A waste management system according to claim 29, wherein at least one of the pollutant monitor and the effluent monitor monitors at least one of i) inorganic materials used by the industrial process and ii) inorganic materials discharged from the industrial process.

[c32]   32. A waste management system according to claim 29, wherein at least one of the pollutant monitor and the effluent monitor monitors at least one of i) a species of acid used by the industrial process and ii) a species of acid discharged from the industrial process.

[c33]   33. A waste management system according to claim 32, wherein the species of acid comprises a chemical compound that ionizes in water to provide a hydrogen ion H^+.

[c34]   34. A waste management system according to claim 29, wherein at least one of the pollutant monitor and the effluent monitor monitors at least one of hydrochloric acid (HCl), nitric acid (HNO_3), perchloric acid ($HClO_4$), sulfuric acid (H_2SO_4), phosphoric acid (H_3PO_4), acetic acid ($HC_2H_3O_2$), hydrogen fluoride (HF), and carbonic acid (H_2CO_3).

[c35]   35. A waste management system according to claim 29, wherein at least one of the pollutant monitor and the effluent monitor monitors at least one of i) a heavy metal species used by the industrial process and ii) a heavy metal species discharged from the industrial process.

[c36]

36. A waste management system according to claim 35, wherein the heavy metal species comprises at least one of lead (Pb), mercury (Hg), chromium (Cr), copper (Cu),

and cadmium (Cd).

[c37] 37. A waste management system according to claim 29, wherein at least one of the pollutant monitor and the effluent monitor monitors at least one of i) an organic species used by the industrial process and ii) an organic species discharged from the industrial process.

[c38] 38. A waste management system according to claim 37, wherein the organic species comprises at least one of an alkane, an alcohol, an ether, an alkene, an alkyne, an aromatic compound, an alkyl halide, an ester, a carboxylic acid, a carbonyl compound, an aldehyde, and a ketone, an amine, and an amide.

[c39] 39. A waste management system according to claim 37, wherein the organic species comprises at least one of benzene (C_6H_6), toluene ($C_6H_5CH_3$), xylene [$C_6H_4(CH_3)_2$], naphthalene ($C_{10}H_8$), dichloromethane (CH_2Cl_2), trichloromethane ($CHCl_3$), styrene, ethylene, phenol, methylene chloride, xylene, and methyl ethyl ketone.

[c40] 40. A waste management system according to claim 29, further comprising at least one computer system communicating with the communications network, the at least one computer system acquiring the process parameter from the globally distributed computing network.

[c41] 41. A waste management system according to claim 29, further comprising a computer system communicating with the globally distributed computing network, the computer system receiving at least one of the pollutant information and the effluent information.

[c42] 42. A system configured for reducing wastes from an industrial process, the system comprising:

a Waste Reduction module acquiring at least one of pollutant information and effluent information communicated along a globally distributed computing network, the pollutant information associated with pollutants produced by the industrial process, and the effluent information associated with effluents discharged by the industrial process; and

a processor capable of manipulating the acquired information and of predicting process parameters that may reduce wastes produced by the industrial process.

[c43]   43. A computer program product for reducing wastes from an industrial process, the
            computer program product comprising:
                    a memory storage device; and
                    a Waste Reduction module stored on the memory storage device, the Waste
                    Reduction module acquiring at least one of pollutant information and effluent
                    information communicated along a communications network, the pollutant
                    information associated with pollutants produced by the industrial process, and
                    the effluent information associated with effluents discharged by the industrial
                    process, the Waste Reduction module predicting process parameters that may
                    reduce wastes produced by the industrial process.

[c44]   44. A central processing center for reducing wastes produced by an industrial process,
            the central processing center comprising:
                    a Waste Reduction module acquiring at least one of pollutant information and
                    effluent information communicated along a globally distributed computing
                    network, the pollutant information associated with pollutants produced by the
                    industrial process, and the effluent information associated with effluents
                    discharged by the industrial process, the Waste Reduction module predicting
                    process parameters that may reduce wastes produced by the industrial process;
                    and
                    a processor capable of predicting the process parameters that may reduce
                    wastes produced by the industrial process.

[c45]   45. A computer program for reducing wastes produced from an industrial process,
            comprising the steps of:
                    communicating with a communications network and acquiring process
                    information concerning the industrial process;
                    predicting a process parameter associated with a predicted waste output
                    according to a predetermined model and based on the process information; and
                    communicating the process parameter over the communications network.

[c46]   46. A computer program for reducing wastes according to claim 45, wherein the step
            of communicating with a communications network comprises communicating with a
            globally distributed computing network.

[c47]   47. A computer program for reducing wastes according to claim 45, wherein the step

of communicating with a communications network comprises communicating with at least one of a local area network, a wide area network, and a globally distributed computing network.

[c48]   48. A computer program for reducing wastes according to claim 45, wherein the step of acquiring process information comprises acquiring at least one of i) concentration of a chemical species used by the industrial process, ii) concentration of a pollutant produced by the industrial process, iii) concentration of an effluent discharged from the industrial process, iv) flow rate of the chemical species used by the industrial process, v) flow rate of the pollutant produced by the industrial process, and vi) flow rate of the effluent discharged from the industrial process.

[c49]   49. A computer program for reducing wastes according to claim 45, wherein the step of acquiring process information concerning the industrial process comprises acquiring information concerning at least one of an effluent stream of air, an effluent stream of water, and an effluent stream of a solid.

[c50]   50. A computer program for reducing wastes according to claim 45, wherein the step of acquiring process information comprises acquiring information concerning at least one of i) inorganic materials used by the industrial process and ii) inorganic materials discharged from the industrial process.

[c51]   51. A computer program for reducing wastes according to claim 45, wherein the step of acquiring process information comprises acquiring information concerning at least one of i) a species of acid used by the industrial process and ii) a species of acid discharged from the industrial process.

[c52]   52. A computer program for reducing wastes according to claim 51, further comprising the step of acquiring information concerning a chemical compound that ionizes in water to provide a hydrogen ion H^+.

[c53]   53. A computer program for reducing wastes according to claim 51, further comprising the step of acquiring information concerning at least one of hydrochloric acid (HCl), nitric acid (HNO_3), perchloric acid ($HClO_4$), sulfuric acid (H_2SO_4), phosphoric acid (H_3PO_4), acetic acid ($HC_2H_3O_2$), hydrogen fluoride (HF), and carbonic acid (H_2CO_3).

[c54]   54. A computer program for reducing wastes according to claim 45, wherein the step of acquiring process information comprises acquiring information concerning at least one of i) a heavy metal species used by the industrial process and ii) a heavy metal species discharged from the industrial process.

[c55]   55. A computer program for reducing wastes according to claim 54, further comprising the step of acquiring information concerning at least one of lead (Pb), mercury (Hg), chromium (Cr), copper (Cu), and cadmium (Cd).

[c56]   56. A method of reducing wastes according to claim 45, wherein the step of acquiring process information comprises acquiring information concerning at least one of i) an organic species used by the industrial process and ii) an organic species discharged from the industrial process.

[c57]   57. A computer program for reducing wastes according to claim 56, further comprising the step of acquiring information concerning at least one of an alkane, an alcohol, an ether, an alkene, an alkyne, an aromatic compound, an alkyl halide, an ester, a carboxylic acid, a carbonyl compound, an aldehyde, and a ketone, an amine, and an amide.

[c58]   58. A computer program for reducing wastes according to claim 56, further comprising the step of acquiring information concerning at least one of benzene (C_6H_6), toluene ($C_6H_5CH_3$), xylene [$C_6H_4(CH_3)_2$], naphthalene ($C_{10}H_8$), dichloromethane (CH_2Cl_2), trichloromethane ($CHCl_3$), styrene, ethylene, phenol, methylene chloride, xylene, and methyl ethyl ketone.

[c59]   59. A computer program for reducing wastes according to claim 45, further comprising the step of acquiring information concerning air pollutant emissions produced by the industrial process.

[c60]   60. A computer program for reducing wastes according to claim 45, further comprising the step of acquiring information concerning a volatile organic compound produced by the industrial process.

[c61]   61. A computer program for reducing wastes according to claim 45, further comprising the step of acquiring information concerning an ozone depleting compound produced by the industrial process.

[c62]   62. A computer program for reducing wastes according to claim45, further comprising the step of forecasting wastes produced by the industrial process, the forecasted wastes based upon the process information.

[c63]   63. A computer program for reducing wastes according to claim 45, further comprising the step of simulating the industrial process with a computer program that determines the process parameters.

[c64]   64. A computer program for reducing wastes according to claim 45, further comprising the step of forecasting costs of operating the industrial process at the process parameter.

[c65]   65. A computer program for reducing wastes according to claim 45, further comprising the step of estimating costs of operating the industrial process at the process parameter.

[c66]   66. A computer program for reducing wastes according to claim 45, further comprising the step of communicating information concerning waste emissions over the communications network to a regulatory agency.

[c67]   67. A computer program for reducing wastes according to claim 45, further comprising the step of communicating information concerning waste emissions over the communications network to participants in a system for buying and selling emissions allowances.